Paper 21: The expected impact and future of the ILCA Subhumid Zone Programme

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Abstract

Joint research between ILCA and national institutes in Nigeria has led to the design and testing of interventions which will improve livestock productivity. Farmer responses and economic models suggest that several lines of research are making promising progress.

Understanding of the complex interactions that constitute livestock production systems has provided a better basis for research and development in Nigeria's livestock sector.

It is recommended that the basic objectives and techniques of the programme's livestock systems research be continued. Nine priority items for future research are suggested. Some descriptive and diagnostic studies are still necessary, but the future emphasis of the programme will increasingly be on component research and intervention testing. Meanwhile, the LSR approach will be transferred to national institutes.

Introduction

This paper discusses the potential impact of the interventions being developed and tested by the Subhumid Zone Programme. Livestock systems research (LSR) depends on cooperation between many individuals and agencies (Dillon and Anderson, 1983). There has thus been a collective effort also involving the National Animal Production Research Institute (NAPRI) and various departments of Ahmadu Bello University (ABU), the Federal Livestock Department (FLD), the National Livestock Project Unit (NLPU), the State Governments of Kaduna, Plateau, Niger, Benue, and the Local Government Authorities where the case studies are carried out.

The most important party in this joint research is the producer. Whilst that is true of cropping systems research as well, the producers cooperating in LSR have to be particularly patient and understanding. They cannot expect to see results in one season, nor dramatic visual evidence of increased productivity. They have to put up with far more questioning and

disturbance of their normal routines. In contrast, agronomic field recording frequently need not involve the farmer at all, and when it does so, it is usually only once or twice a year, but weighing of animals and questions on the reasons for sales and sale prices go on throughout the year.

Most of the ILCA Subhumid Zone Programme's research is being conducted in three contrasting case study areas in the subhumid zone of Nigeria (Papers 3 and 11). One is an area of government-assisted settlement on a grazing reserve; the second is an area of agropastoral settlement amongst arable farming communities; the third, added in 1984, allows the programme to study mixed crop-livestock situations. The research centres about the single theme of animal nutrition. It does so either directly, through feeding trials, or indirectly through exploring such issues as land tenure, which affect the availability of land on which to grow fodder.

The diagnostic research, now largely completed, has established improved understanding of the systems and the complex inter-relationships within and between them (Papers 3 to 14). The new understanding has created a sounder basis for development planning as well as for future research in the subhumid zone as a whole. In particula,r it has explained land use and farming systems, and detailed the value of crop residues and how they are utilized by cattle (Papers 11, 13 and 14). At the same time, it has revealed the difficulty of devising interventions that will improve feed resources when the cultivators/land owners do not own the livestock (Paper 15).

The design and testing phase of the research, which is now the main activity of the programme, has resulted in the development of interventions which form a coherent strategy for increasing livestock productivity. The strategy consists of:

1. Making better use of existing feed resources (strategic feeding).

2. Promoting increased output of improved forage while also boosting food crop production (new crop-forage techniques).

3. Using more productive animals (crossbred dairy production).

These interventions are discussed in more detail in the following sections.

Strategic feeding

Dry-season supplementation has reached the farmer managed, farmer- implemented phase in LSR (Paper 10), and is being promoted by the NLPU. As reported in Paper 19, it has not progressed as well as hoped, but the adoption and extension problems it is revealing are important to the research and development process and the success of future interventions.

It was known from the outset that there were inadequate feedstuffs on the market in Nigeria and that demand from other livestock would further reduce the quantities available for cattle and drive up prices. This has in fact occurred. At the start of the research, cottonseed cake cost 0.06 Naira per kg (Synge, 1980). Only 4 years later, it now costs upwards of 0.3 Naira per kg. Its price has risen fivefold, while livestock values have only doubled over the same period. As can be seen from Table 9 in Annex 1, the present cost-price relationships result in negative incremental net cash flaws until increased calving and decreased calf mortality generate increase livestock sales.

The data analysed so far provide evidence of improved calf viability, but the improved fertility reported by Synge (1980) and indicated in ILCA's earlier researcher-managed trials has so far not been manifested under farmer management (Paper 10). Possibly the supplementation only increases milk production without being sufficient to break the nutritional anoestrus typical of

lactating cows under traditional management (Paper 6). Possibly too, the cows have not been getting the recommended quantities of feed (Paper 18) as pastoralists shared the rations among larger numbers of animals. Certainly, ILCA failed to defeat the considerable variability in the effects of nutritional stress on animals: some animals are in effect starving to death. If feed becomes available, owners are bound to feed such animals. ILCA's observation is that there are on average three to five such animals per herd and that, given the high value of animals, saving them is an economically rational response (Paper 18). The difference between the value of an animal slaughtered in extremis and its value on recovery is estimated at about 400 Naira. That is equivalent to about half the annual supplementary feed bill or half the incremental sales revenue derived from milk.

If provision is made to feed all cows in order to break nutritional anoestrus as well as any animal in danger of dying or being sold in extremis, not only will livestock owners be more amenable to extension advice (Paper 18) but also the animals themselves are more likely to respond as they have done elsewhere (Paper 10). Alternatively, direct supplementary feeding of calves may be more efficient in reducing -calf mortality and allowing owners to take off a higher proportion of milk from cows.

Table 10 of Annex 1 gives a summary of projected increases in output from supplementary feeding. Milk offtake would increase 58% and beef production 36%, providing a 21% per annum increase in protein production per stock unit.

If similar increases are projected for the whole of the Nigerian subhumid zone (Paper 2), an extra 2.7 million kg of protein worth some 95 million Naira per annum would result. This huge untapped potential suggests that there should be very attractive returns to research into improved cattle nutrition. However, the slim margins evident at the herd level (Annex 1, Table 9) suggest that either a cheaper source of quality feed must be found and/or the cattle raised must be more productive than the unimproved Bunaji. ILCA is exploring both these options, through research on improved forage and crossbred cattle.

New crop-forage techniques

Undersowing of cereal crops with Stylosanthes

The research on undersowing of cereal crops with Stylosanthes has shown that it is possible to maintain cereal yields at a reasonable level while producing useful quantities of high-protein fodder (Paper 15). However, time of undersowing is critical and the intervention is likely to be adopted only when land and animals are owned by the same person. It will be more appropriate when livestock are few relative to land area cultivated - as, for instance, in feeding draught animals - and where land will subsequently be left fallow. Nevertheless, farmers in one of ILCA's case study areas have shown considerable interest in undersowing.

Annex 2 analyses the trade-offs in terms of varying prices for the varying yields recorded. The sensitivity analysis allows readers to assess the merits of undersowing according to their own judgement of relative prices. This approach has been taken because it is impossible to obtain any consensus on the farm gate prices of Nigerian agricultural commodities. In Nigeria, they vary; by district, by season, by year, according to quantities imported and due to actual or supposed political moves. In the last 12 months, the farm gate prices recorded for sorghum grain have varied from 40 Naira per 100 kg bag to peaks approaching 200 Naira.

In ILCA's own case study areas, there is no established market for fodder, although there is one in adjacent northern areas where grazing pressures are greater. Fodder marketing will probably spread southwards with increasing settlement. If it is assumed that crop residues are worth 0.05 Naira per kg and sorghum grain 0.40 Naira per kg, then the Stylosanthes hay would have to be worth between 0.10 and 0.20 Naira per kg to break even (Annex 2, Tables 1

and 2). At any Value above that, it would be profitable to grow. For example, at 0.25 Naira per kg of Stylosanthes hay returns per hectare would increase by 22%. The cost of lost grain will be a relatively cheap price to pay for establishing the legume on land that will subsequently be left as a legume fallow. The benefits of planting Stylosanthes rather than relying on natural fallow have not been quantified, but there are encouraging results from bioassay trials and soil quality measurement (Paper 15). Although the fallow land that farmers can control is limited in heavily farmed areas, it could be an important source of feed during the nutritionally critical late wet season, when the presence of growing crops limits grazing.

If forage legumes can be found that compete less with the crop, so much the better (Paper 15). Sorghum is by no means the only cereal crop, and maize in particular is gaining in popularity. This trend could herald problems for the livestock sector owing to the earlier deterioration of the crop residue's feeding value. However, maize is much better suited to undersowing, and ILCA's trials suggest that the trend towards it may be turned to the advantage of livestock by undersowing techniques (Paper 15).

Crop geometry adjustments to accommodate two-crop - one-forage mixture

By combining the undersowing of sorghum with soyabean and the inter-row sowing of Stylosanthes, subsistence crop yields can be maintained (by doubling the plant population per unit area) whilst growing considerable quantities of forage (Paper 15). Conditions for the use of this technique are much as indicated above for undersowing, but where the legume will be in rotation rather than left as a fallow crop.

The sensitivity analysis again suggests that the legume fodder need not command high prices for this to be a worthwhile approach.

Establishment and utilization of legume fodder banks

Fodder banks still need further testing and adaptation, but this intervention is receiving very encouraging support from producers and extension workers. The aim is to produce fodder for supplementing the low-protein diet from natural range for a selected proportion of the herd (Paper 16).

An economic appraisal of fodder banks is given in Annex 4. The assumptions used in the appraisal are considerably less ambitious than those used in typical livestock project analysis (Botswana, 1977; von Kaufmann, 1979). The fodder bank model priced in Annex 4 Table 1 is the 'blue-ribbon' one using metal posts and sheep-proof fencing. The utilization of bush poles (preferably for live fencing) and three-strand barbed wire would reduce costs considerably. As can be seen from Annex 4 Table 14, the cost of the 'blue-ribbon' model is equivalent to 12% of the herd value. On existing evidence the fodder bank would repay that in 2 to 3 years just by saving stressed animals. If the fodder bank is financed with loan capital at 7% per annum over 5 years, the repayments amount to about 24% of initial annual earnings.

Given the average Stylosanthes yields achieved in 1981 and 1982, it is cheaper to provide protein from fodder banks than from cottonseed cake (Annex 4, Table 4). When inflation is taken into account, the Stylosanthes has a distinct advantage because the recurrent costs are less. A further hidden advantage is that the labour input into the fodder bank may not have to be paid for by livestock owners or their families, since they may be able to fit fodder bank construction and maintenance into off-peak periods.

As in the case of feeding with cottonseed cake, the cash flows do not look very attractive in the early years. However, this conclusion is belied by the very strong interest of livestock owners (Paper 18). The fact that the milk benefits accrue largely to the women (supplementary paper) has not dissuaded the men from either using their own cash or incurring substantial debts to acquire fodder banks. Despite the poor season of 1983, when forage yields were half those of

previous years, the drop-out rate among participants was low and several fodder banks were expanded (Paper 19).

The major deterrents to the adoption of fodder banks will be the difficulty of acquiring sufficient land, and the problems of operating a complex management system (Paper 16). Fire is also a serious hazard and, as 1983 proved, there will be years when poor rainfall limits yields (Paper 19).

The greatest danger that needs urgent resolution is the dependence on virtually one legume variety: Stylosanthes hamata cv Verano (Paper 16). New varieties resistant to anthracnose are urgently needed, as also are suitable legume/grass mixtures

Use of fodder banks for improved crop production

Research on cereal cropping within fodder banks is being carried out for three reasons. Firstly, the improved fertility and texture contributed to the soil by legumes should be exploited for food cropping. Secondly, improved food crop yields from fodder banks will encourage livestock producers to obtain, and farmers to permit, the use of the necessary land for fodder banks. Thirdly, the presence of crops will make the fodder banks more secure because of the strong tradition of public respect for crops.

As reported in Paper 15 the results of this research are encouraging and conform to expectations based on Australian and other work, but there are not yet enough data on which to base an economic analysis. The trials need to be extended to include farm-level production so that the labour inputs can be determined. This work will have to be sensitive not only to the direct cost of labour but also to any opportunity costs, such as delays imposed on other operations.

Crossbred dairy production

Once pastoralists can produce their own fodder, they will want to use it better by keeping more productive cattle. Crossbred Friesian x Bunaji cows have repeatedly shown the potential to give double the milk offtake of indigenous stock (von Kaufmann, 1979). They are more susceptible to endemic diseases, but experience suggests that this problem can be overcome by reasonably simple techniques (Paper 8).

No firm conclusions can yet be drawn, but the models in Annexes 5a and 5b suggest that, even with a low milk output of 712 litres per cow per annum, crossbred dairy production is economically viable if milk can be sold at current direct (producer-to-consumer) prices. These prices will probably be maintained or else rise for as long as the government limits powdered milk imports, which it will doubtless continue to do, given its determination to raise domestic milk production (Federal Ministry of Agriculture, 1981) and encourage the spread of crossbred animals. Crossbred dairy production is therefore an appropriate line of research for the medium or long term.

Given adequate nutrition and management, the milk offtake from just two crossbred cows approaches that from a whole herd of Bunaji cows under traditional management. This quantum jump in output is bound to cause problems in uptake: firstly, wives will find it difficult to dispose of the large extra quantities, and secondly, the producers' neighbours will suffer reduced prices. Milk collection schemes cannot operate unless there is surplus local production, which will not materialize until there is an adequate outlet. The Subhumid Zone Programme is preparing a research proposal which, if accepted, will shift the main location of ILCA's crossbred trials to the peri-urban areas of Kaduna. If a milk collection and marketing scheme can be successfully launched in these areas, further schemes can be designed for more remote locations.

The potential impact of crossbred dairy production is enormous. Crossbred genes could be spread very rapidly by artificial insemination. Through the Smallholder Fattening Scheme Nigeria has considerable experience in keeping small numbers of cattle on supplementary feed. The country's high population and many urban centres make milk marketing for more feasible than in many other African nations. Domestic demand for milk has been projected at 1 053 600 tonnes in 1985, with 576 900 tonnes being imported. The figure far imports is based on optimistic assumptions that the national herd will have grown to 13.9 million head, that 69% of all cows will be in milk, and that each will yield an offtake of 630 kg per annum. The truth is that Nigeria will need all the milk it can produce.

Indirect spin-offs from the research programme

While impact at the producer level is the main objective of ILCA's programme, the research has had other spin-offs. A comparison between problems and attitudes in 1978 and these of today indicates some of the effects that LSR is having on policy making for livestock research and development in Nigeria.

Development policies in 1978

Despite evidence from van Raay (1975) and others that many of the Fulani were semi-sedentary, Nigerian development and extension agencies in 1978 were almost fatally preoccupied with the need to induce the nomads to settle. The solution to the 'problem' of settlement was thought to lie in the creation of grazing reserves planned according to standard range management practice. The plans called for year-round rotational grazing, excluded cultivation and made no reference to linkages with agriculture. That only a small proportion of a national herd with a grazing requirement of over 30 million ha could be catered for by even the most ambitious grazing reserve programme, was a problem never properly addressed. Large sums of money were invested in infrastructure such as dams, access roads and firebreaks, buildings for extension staff and milk collection centres. None of these inputs were adapted to communal grazing/multiple ownership systems, and as a result there was little motivation for contact between extension staff and pastoralists.

Animal husbandry and forage innovations were limited to the keeping of a few demonstration cattle and the introduction of highly mechanized pasture development of dubious relevance to pastoralists. Sporadic attempts to increase production relied on the provision of subsidized unrationed feedstuffs, particularly at times of drought. Whilst a lot was being done for the pastoralists in terms of communal facilities such as watering points and range management schemes, routine veterinary service were virtually the only relevant and successful government input at herd level.

Understanding of livestock numbers and their distribution through time and space was based more on opinion than on verified facts. In particular, the subhumid zone was thought to be only a dry-season grazing area for nomadic cattle, with little permanent settlement. Rapid remote sensing techniques had only been applied in a minor way for wildlife, and had yet to be developed for the study of livestock distribution and human settlement patterns.

Research policies in 1978

In 1978, there was little contact between livestock research and livestock development. The prevailing opinion, endorsed by ILCA, was that research was far ahead of development and that the great need was to implement what was already known. This was so strongly held that the ILCA team was not provided with any experimental plots or animals. All its work was to be done directly with pastoralists' herds on the basis of existing knowledge. This situation has been remedied by the combined generosity of the Kaduna State Government, the National Livestock Project Unit and the Federal Livestock Department, who helped the team acquire

land and animals for research.

Production systems were not understood because they had not been studied, particularly as regards crop-livestock interactions. Research on livestock production was confined to research stations. Apart from veterinary work, contact with pastoralists was restricted to questionnaire surveys. Project funding for research was directed only towards pasture development on ranches, and in the event hardly utilized. NAPRI was not directly involved in LSR. And there were no sites for demonstrating LSR techniques and products to extension staff.

Whilst the need for improved nutrition for cattle in the subhumid zone had been widely recognized and promising legumes and grasses had been tested at research stations, little was being done to develop suitable techniques for pastoralists to grow or utilize their own forages.

Development policies in 1984

ILCA participated in the subsector review of the Nigerian livestock industry (Federal Ministry of Agriculture, 1981). Research results from the Subhumid Zone Programme were thus used to help formulate development policy. In particular, ILCA provided much of the baseline productivity data on pastoral cattle. The LSR results helped redirect the thinking of policy makers towards the needs of settled pastoralists. The importance of crop-livestock interactions was recognized, as were the need to incorporate grazing reserves into the overall land-use system, the potential of dairying and the linkage between the sale of dairy and grain products (Supplementary Paper). The significance of these factors is already so widely accepted that it is easy to forget that it was not always so.

ILCA data have been used to devise the settled pastoralist and mixed farmer models now being prepared for the Nigerian Second Livestock Development Project. Advice to pastoralists on forage production has replaced grazing control as the main function of grazing reserve extension staff. ILCA has acted as a catalyst for development through on-site demonstrations in the course of its trials, and through helping to produce a promotional film for the National Livestock Project Unit. ILCA has also conducted courses for extension staff.

Research policies in 1984

The members of the 1980 Livestock Subsector Review were repeatedly frustrated by the lack of reliable data on livestock numbers and distribution. Even when cattle were known to be in an area, it was frequently not understood why, nor what association they had with other components of the physical and socio-economic environment. Estimates of the national herd varied by about 40%, which made all projections highly tenuous. The subsector review recommended a nation-wide aerial survey.

By 1984, rapid resource survey techniques had been developed which enabled the relationships between livestock, agriculture and infrastructural development to be quickly and cheaply determined. Nigeria's aerial survey results can now potentially be correlated with remote sensing data and verified by ground truthing. Photographic techniques have been developed and tested which allow cropping patterns to be enumerated even in mixed cropping systems.

As of 1984 the ILCA team has had 5 years' practical experience in LSR and has developed methods for others to use. If the baton can be passed on to national teams (Paper 20), significant and more widespread inpact will result.

ILCA has specific training activities in which many Nigerians have participated. Additionally, graduates on National Youth Service have been posted to the Subhumid Zone Programme, and personnel from State Ministries of Agriculture have been seconded to the programme for

periods of 1 year. Visits to the programme by university staff and students have also been arranged to complement existing field training facilities.

Future research

The research objective set in 1979, namely to find ways of improving cattle nutrition, is still the focus of the ILCA Sub humid Zone Programme. Nothing that has since been discovered suggests that the objective is either inappropriate or unattainable, though it is certainly more complex than initially perceived. Research by national institutes and ILCA should therefore continue to follow the present lines, but with the emphasis changing even more towards component research and intervention testing. The following major research objectives have been identified:

1. New legume varieties must be found and management systems developed to suit them. The present dependence on just one variety of Stylosanthes is very dangerous because of the threat of anthracnose.

2. Legume-cereal crop interactions are of the utmost importance to the future of forage production in the zone. Work on identifying the best techniques and management systems for particular target groups must continue.

3. Crop-livestock interactions need to be studied further with a view to improving the feeding value of crop residues. Work on draught power should also be initiated.

4. Nutrition research needs to look more closely at the feeding of calves, since it may be more cost-effective to reduce calf mortality this way than by increasing milk production.

5. The number of crossbred cows and participant dairy producers Should be expended to provide a basis for statistical analysis. The research Should be conducted closer to Kaduna urban markets.

6. The nutrition of cattle through fodder banks should continue to be a two-way study: effect on cow, effect on legume. The design of the research should reflect the opinions and practices of beneficiaries.

7. Animal health research should concentrate on diseases that may increase with or affect the adoption of interventions. Tick-borne diseases, reproductive disorders and trypanosomiasis are pertinent examples.

8. Possible interventions for small ruminants include disease control, improved male-to-female ratios and late wet-season feeding. These interventions should be tested on flocks belonging to both farmers and pastoralists.

9. Extension and its credit and supply back-up will have to become an important subject of research, the objective being to design interventions with minimum dependence on extension and credit whilst at the same time seeking to improve the effectiveness of essential extension services.

Conclusions

As it gains in experience, ILCA's Subhumid Zone Programme will contribute more to livestock research and development in Nigeria. Over time, increasing emphasis is being laid on component research and implementation testing. If the research is continued, its cost-effectiveness will thus improve. The past investment in understanding the system will

increasingly pay off as essential knowledge, which was not available in 1978, is used to design more appropriate interventions for testing. At the same time this store of better knowledge will enable the programme to provide government with data that will help improve policy decisions. Finally, close cooperation between ILCA and NAPRI in future years should eventually enable the latter institute to take the lead and expand its activities in national LSR.

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